

REMARKS

With this amendment, claims 1-3, 11, 35, 42, 52, 55, 58, and 60-62 have been amended and claims 56, 57 and 59 have been canceled. Claim 63 has been added. The Applicant has carefully and thoughtfully considered the Office Action and the comments therein. For the reasons given below, it is submitted that this application is in condition for allowance.

35 U.S.C. § 112, Second Paragraph Rejection

In the Office Action on pages 2-3, claims 52, 54, 56, and 60-62 are rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to point out and distinctly claim the subject matter of the invention. The Applicants respectfully traverse the rejections.

(1) Claim 52 is rejected under § 112, second paragraph because the phrase “such as” is alleged to make it unclear whether the limitations following the phrase are part of the claimed invention. Office Action, p. 2. Claim 52 has been amended to remove the phrase “such as phenyl and naphthyl.” Thus, the rejection is moot, and withdrawal of the rejection of claim 52 is respectfully requested.

(2) Claim 54 is rejected under § 112, second paragraph because the claim element “wherein Ar is a cyclopentadienyl group” (line 2) allegedly lacks sufficient antecedent basis in claim 11, from which claim 54 depends, because Ar is defined in claim 11 as “an optionally substituted *aryl* moiety” (Office Action at p. 2, emphasis in original). Applicants respectfully traverse. Claim 11 depends from claim 1, which recites “a Group VIII metal compound,” a cation. Therefore, it would be clear to a person of ordinary skill that the cyclopentadienyl group recited in claim 54 is an anion. Because an anionic cyclopentadienyl group is aromatic, the cyclopentadienyl group is encompassed

within “optionally substituted aryl moiety,” as recited in claim 11. Accordingly, the claim is not indefinite, and withdrawal of the rejection of claim 54 is respectfully requested.

(3) Claim 56 is rejected under § 112, second paragraph as indefinite. Claim 56 has been canceled, thus rendering this rejection moot.

(4) Claim 60 is rejected under § 112, second paragraph, because the claim element “wherein said solvent is as defined in claim 1” allegedly lacks antecedent basis. The Office Action alleges that “claim 1 does not recite a solvent being present.”

Claim 60, as amended, recites “wherein said solvent is as defined in claim 2.” Claim 2 recites “in the presence of a catalyst system and a solvent.” Accordingly, claim 2 provides antecedent basis for the claim element “wherein said solvent is as defined in claim 2” in claim 60. Thus, the rejection is moot, and withdrawal of the rejection of claim 60 is respectfully requested.

(5) Claims 61 and 62 are rejected under § 112, second paragraph, because the claims allegedly do “not set forth any steps involved in the method/process.” Office Action, p. 2. Claim 61 has been amended to recite “A process for the hydroformylation of ethylenically unsaturated compounds, said process comprising the step of reacting said ethylenically unsaturated compound with carbon monoxide and hydrogen, in the presence of a catalyst system as defined in claim 1.” Accordingly, claim 61 recites one or more steps involved in the claimed processes. Claim 62 has been amended in a similar fashion. Accordingly, claims 61 and 62 are not indefinite, and withdrawal of the rejections of claims 61 and 62 is respectfully requested.

35 U.S.C. § 102 Rejections

(1) In the Office Action on page 3, claims 57-59 are rejected under 35 U.S.C. § 102(b) as being anticipated by P.W. Wang et al., “A Polymer-Bound Bidentate-Phosphine-Palladium Complex as a Catalyst in the Heck Arylation” (hereinafter P.W. Wang). As noted above, claims 57 and 59 are cancelled. The Applicant respectfully traverses the rejection.

Claim 58, as amended, recites “[a] hydroformylation reaction catalyst system for the catalysis of ethylenically unsaturated compounds with carbon monoxide and hydrogen in the presence of said system, the catalyst system obtainable by combining: a Group VIII metal compound as defined in claim 1; and a bidentate compound as defined in claim 1, and wherein the catalyst system is characterised in that a chlorine moiety is present in at least said Group VIII metal compound.” The bidentate compound of claim 1 has two tertiary carbon groups bound to each of groups Q1 and Q2. P.W. Wang fails to teach, or fairly suggest, claim 58 for at least the following reason.

P.W. Wang fails to teach tertiary carbon groups bound to groups Q1 and Q2, as recited in claim 58 via claim 1. In rejecting claim 58, the Office Action aligns the recited bidentate compounds containing tertiary carbons with the bidentate phosphine-palladium complex disclosed in P.W. Wang. P.W. Wang teaches the use of monomeric and polymeric catalysts, catalytic precursors such as certain bidentate phosphine-palladium complexes and other compounds in the Heck arylation of methyl acrylate with iodobenzene. P.W. Wang, p. 5359. In the bidentate phosphine disclosed by P.W. Wang, each phosphine is bound to **isopropyl and aryl groups**. P.W. Wang, p. 5359. P.W. Wang does not teach tertiary carbons bound to groups Q1 and Q2, as in the claimed bidentate compounds. Thus, P.W. Wang fails to teach “a bidentate compound of general

formula (Ia), **wherein R¹ to R¹² each independently represent lower alkyl, aryl or Het,**” and claim 58 is allowable over P.W. Wang.

(2) In the Office Action on pages 3-4, claims 57-59 are rejected under 35 U.S.C. § 102(b) as being anticipated by M.K. Richmond et al., “Preparation of New Catalysts by the Immobilization of Palladium(II) Species onto Silica: An Investigation of Their Catalytic Activity for the Cyclization of Aminoalkynes” (hereinafter Richmond). As noted above, claims 57 and 59 are cancelled. The Applicant respectfully traverses the rejection.

Claim 58 has been set forth above (see p. 17). As noted there, in the bidentate compounds of claim 1, two tertiary carbon substituents are bound to each of groups Q1 and Q2. Richmond fails to teach, or fairly suggest, claim 58 for at least the following reason.

Richmond fails to teach tertiary carbon groups bound to groups Q1 and Q2, as recited in claim 58 via claim 1. In rejecting claim 58, the Office Action aligns the recited bidentate compounds containing tertiary carbons with the hydroxo and methyl palladium complexes of Richmond. Richmond teaches the use of several silica-bound palladium catalysts for the cyclization of aminoalkynes. Richmond, p. 10522. Richmond teaches complexes in which the phosphine is **trisubstituted with methyl, phenyl or cyclohexyl groups** (p. 10523) and does not teach tertiary carbons bound to groups Q1 and Q2, as in the bidentate compounds of claim 58. Thus, Richmond fails to teach “a bidentate compound of general formula (Ia), **wherein R¹ to R¹² each independently represent lower alkyl, aryl or Het,**” and claim 58 is allowable over Richmond.

(3) In the Office Action on page 4, claims 57-59 are rejected under 35 U.S.C. § 102(b) as being anticipated by C.N. Iverson and W.D. Jones, “Rhodium-Catalyzed Activation and

Functionalization of the C-C Bond of Biphenylene” (hereinafter Iverson). As noted above, claims 57 and 59 are cancelled. The Applicant respectfully traverses the rejection.

Claim 58 has been set forth above (see p. 17). Iverson fails to teach, or fairly suggest, claim 58 for at least the following reason.

Iverson fails to teach “a hydroformylation reaction catalyst system,” as recited in claim 58. In rejecting claim 58, the Office Action aligns the recited hydroformylation reaction system with the use of bidentate phosphines in the breaking of C-C bonds and the functionalization of biphenylene, as taught in Iverson. However, Iverson teaches catalyst systems **for the breaking of C-C bonds and functionalization of biphenylene** (p. 5745) and does not teach a **“hydroformylation reaction catalyst system”** as recited in claim 58. Thus, claim 58 is allowable over Iverson.

(4) In the Office Action on page 4, claims 57-59 are rejected under 35 U.S.C. § 102(b) as being anticipated by P. Hofmann et al., “Bis(di-t-butylphosphino)methane complexes of rhodium: homogeneous alkyne hydrosilylation by catalyst-dependent alkyne insertion into Rh-Si or Rh-H bonds. Molecular structures of the dimer [(dtbpm)RhCl]₂ and of the silyl complex (dtbpm)Rh[Si(OEt)₃](PMe₃)” (hereinafter Hofmann). As noted above, claims 57 and 59 are cancelled. The Applicant respectfully traverses the rejection.

Claim 58 has been set forth above (see p. 17). Hofmann fails to teach, or fairly suggest, claim 58 for at least the following reason.

Hofmann fails to teach “a hydroformylation reaction catalyst system,” as recited in claim 58. In rejecting claim 58, the Office Action aligns the recited hydroformylation reaction catalyst system with the alkyne hydrosilylation reaction system of Hofmann. However, Hofmann teaches two different types of **catalyzed alkyne hydrosilylation reactions** (p. 53) and does not teach a

“hydroformylation reaction catalyst system” as recited in claim 58. Thus, claim 58 is allowable over Hofmann.

(5) In the Office Action on page 4, claim 60 is rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Pat. No. 4,504,684, to Fox et al. (hereinafter “Fox”). The Applicant respectfully traverses the rejection.

As amended, claim 60 recites “a hydroformylation reaction medium, wherein said medium comprises a catalyst system and a solvent, wherein said system is for use in a process for the hydroformylation of ethylenically unsaturated compounds and which process comprises reacting said ethylenically unsaturated compound with carbon monoxide and hydrogen, in the presence of said system and said solvent, wherein said solvent is as defined in claim 2, the catalyst system obtainable by combining: a metal of Group VIII or a compound thereof as defined in claim 1; and a bidentate compound as defined in claim 1, and wherein the reaction medium is characterised in that a chlorine moiety is present in at least one of the said Group VIII metal compound or said solvent, including the possibility of being present in both.” The bidentate compounds of claim 1 have two tertiary carbon substituents bound to each of groups Q1 and Q2. Fox fails to teach, or fairly suggest, claim 60 for at least the following reason.

Fox fails to teach a catalyst system in which the bidentate compound has tertiary carbon substituents bound to groups Q1 and Q2, as recited in claim 60 via claim 1. In rejecting claim 60, the Office Action aligns the recited bidentate compounds with the polymeric transition metal catalysts of Fox. Fox teaches the use of polymeric transition metal catalysts in which two alkyl or aryl groups are bonded to X. Col. 3, lines 1-3, 35-39, 51. Fox does not specify **two tertiary carbon groups bonded to the X substituent** in its generic polymeric catalyst, as recited in claim

60 via claim 1, and only exemplifies bidentate phosphines substituted with phenyl groups. Column 5, lines 40-53. A genus is anticipatory only if the claimed compounds can be “at once envisaged” from the generic formula, and one may look to the preferred embodiments to determine which compounds can be anticipated. MPEP § 2131.02. Thus, Fox fails to teach “a bidentate compound of general formula (Ia), wherein **R¹ to R¹² each independently represent lower alkyl, aryl or Het,**” and claim 60 is allowable over Fox.

35 U.S.C. § 103 Rejection Based on Fox in view of X.L. Wang

In the Office Action on pages 4-6, claims 1-47 and 51-55 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Fox in view of U.S. Pat. No. 6,348,621, to X.L. Wang et al. (hereinafter “X.L. Wang”). The Applicants respectfully traverses the rejections.

Claims 1-47 and 51-55 are non-obvious over the references cited. The claimed process provides unexpectedly superior results achieved by employing bidentate compounds with tertiary carbon substituents, as recited in independent claims 1 and 2, and these results are not disclosed or suggested by any reasonable combination of Fox and X.L. Wang.

Independent claim 1 recites “A process for the hydroformylation of ethylenically unsaturated compounds, which process comprises reacting said ethylenically unsaturated compound with carbon monoxide and hydrogen, in the presence of a catalyst system, the catalyst system obtainable by combining: a) a Group VIII metal compound; and b) a bidentate compound of general formula (Ia) . . . wherein: R is a bridging group; R¹ to R¹² each independently represent lower alkyl, aryl or Het; Q¹ and Q² each independently represent phosphorus, arsenic or antimony, the process characterised

in that a chlorine moiety is present in at least said Group VIII metal compound.” Independent claim 2 is similar to claim 1 in aspects relevant here.

Fox teaches the use of polymeric transition metal catalysts. Col. 3, lines 1-3. Its generic formula discloses compounds in which two alkyl or aryl groups are bonded to X. Col. 3, lines 35-39, 51. However, Fox only exemplifies bidentate phosphines with aromatic groups bonded to the phosphorus (see Col. 5, lines 40-45 and 50-53), and thus provides no motivation to select the claimed bidentate compounds with tertiary carbon substituents. In addition, with respect to claim 11, Fox provides no motivation to select a 1,2-substituted aryl moiety in the bridging group “to which A and B are linked on available adjacent carbon atoms” (claim 11), instead listing only meta-phenyl and para-phenyl (Col 3, lines 47-48).

Furthermore, the claimed process exhibits unexpectedly superior selectivity for linear products over branched products, as measured by linear-to-branched ratio. Fox exhibits a linear-to-branched ratio on the order of 2:1 (see Col. 6, lines 5-8: 60.6% n-butyraldehyde, 35.3% isobutyraldehyde). In contrast, the claimed process yields a linear-to-branched ratio of from about 4:1 to about 5.72:1 in most cases (see Examples 2-6, paragraphs 232, 234, 239 and 241), with one example achieving a 100% selectivity for the linear product (see Example 7, paragraph 243). The claimed processes thus demonstrate unexpectedly superior selectivity for linear products over that disclosed in Fox, and Fox provides no teaching or suggestion that the claimed processes, which employ bidentate compounds with tertiary carbon substituents, would provide such superior results.

X.L. Wang fails to cure the defect in Fox. X.L. Wang discloses a process for the carbonylation of ethylene using a catalyst system comprising a generic bidentate phosphine. Abstract. However, X.L. Wang only discloses effectiveness on ethylene (see Col. 1, lines 41-45),

not on olefins generally, as in the claimed processes. Furthermore, X.L. Wang's process produces only the corresponding carboxylic acid or ester (Col. 4, lines 6-10). X.L. Wang does not disclose or suggest any utility in producing aldehydes, as in the claimed hydroformylation processes.

Furthermore, X.L. Wang does not disclose or suggest the unexpectedly superior linear-to-branched ratio achieved by the claimed hydroformylation processes. Therefore, no reasonable combination of Fox and X.L. Wang discloses or suggests the unexpectedly superior results achieved by the processes claimed in independent claims 1 and 2, and claims 1 and 2 are allowable over Fox and X.L. Wang. Claims 4-47 and 51-55 are dependent from claim 1 and are allowable as being dependent from an allowable claim. Similarly, claim 3 depends from claim 2 and is allowable as being dependent from an allowable claim.

CONCLUSION

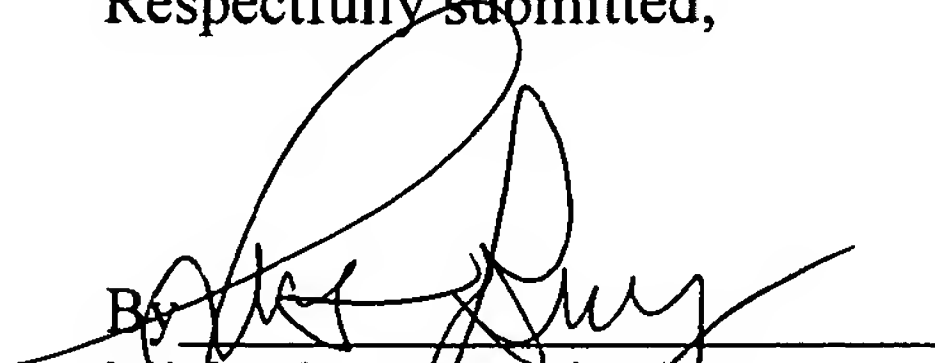
All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn.

Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

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Respectfully submitted,


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